

REMARKS

Claims 1-35 are now pending in the application. Minor amendments have been made to Claims 1, 29-32, and 34 to clarify the Claims. The amended claims contained herein are of equivalent scope as originally filed and, thus, do not involve a narrowing amendment. The Examiner is respectfully requested to reconsider and withdraw the rejection(s) in view of the amendments and remarks contained herein.

REJECTION OF CLAIMS 1-3, 9, 11-14 UNDER 35 U.S.C. § 102

Applicants traverse the rejection of Claims 1-3, 9, 11-14, and 29-35 under 35 U.S.C. § 102(b) as being anticipated by McCoy (U.S. Pat. No. 4,340,829).

Referring now to Claim 1, McCoy does not show, teach or suggest an electric machine with a circumferentially segmented stator. McCoy also does not show, teach or suggest a winding end cap assembly for a stator segment assembly of the circumferentially segmented stator.

McCoy shows a circumferentially continuous stator core 10 that is not segmented. There are no stator segment assemblies. The circumferentially continuous end caps 40 are connected to the entire stator and not to a stator segment assembly as claimed.

McCoy also does not show, teach or suggest a first inner winding retainer section that extends axially to connect an inner end of the first end cap to an inner end of the second end cap.

McCoy shows a sleeve 30 that connects a lower middle portion of one end cap 50 to a lower middle portion of another end cap 40 as can be seen in FIGs. 1 and 2.

The connection of the sleeve 30 to the end cap 40 is spaced from the inner end of the end cap 40. Therefore, the sleeve 32 is not connected at the inner end of the end caps 40. Rather, the McCoy device includes flanges 52 that are connected to the inner ends of the end caps 40. The flanges 52 extend axially from the inner ends of the end caps 40 but do not connect the inner end of one end cap 40 to an inner end of the other end cap 40 as set forth in Claim 1.

For the foregoing reasons, Applicants believe that Claim 1 is in condition for allowance. Claims 2-14 are directly or indirectly dependent upon Claim 1 and are allowable for the same reasons.

REJECTION OF CLAIMS 29-35 UNDER 35 U.S.C. § 102

Applicants traverse the rejection of Claims 29-35 under 35 U.S.C. § 102(b) as being anticipated by McCoy (U.S. Pat. No. 4,340,829).

Referring now to Claims 29 and 34, McCoy does not show, teach or suggest a circumferentially segmented stator for an electric machine. McCoy does not show, teach or suggest a stator segment assembly.

McCoy shows a circumferentially continuous stator that is not segmented ~ therefore, there are no stator segment assemblies.

McCoy also does not show, teach or suggest a stator core for a stator pole. The stator core in McCoy is circumferentially continuous and is therefore a stator segment core for a plurality of stator poles.

For the foregoing reasons, Applicants believe that Claims 29 and 34 are in condition for allowance. Claims 30-33 are directly or indirectly dependent upon Claim

29 and are allowable for the same reasons. Claim 35 is directly dependent upon Claim 34 and is allowable for the same reasons.

REJECTION OF CLAIMS 15-19 UNDER 35 U.S.C. § 103

Applicants traverse the rejection of Claims 15-19 under 35 U.S.C. § 103(a) as being unpatentable over McCoy (U.S. Pat. No. 4,340,829) in view of Trago et al. (U.S. Pat. No. 5,806,169) and Barr (U.S. Pat. No. 1,756,672).

Regarding Claim 15, none of the references alone or in combination show, teach or suggest a switched reluctance electric machine including a plurality of stator segment assemblies each with a stator segment core.

The Examiner asserts that it would be obvious to combine the segmented stator shown in Barr with the switched reluctance motor in Trago et al.

The facts in this case do not support the Examiner's assertion. Despite the existence of the two separate teachings (segmented stators and switched reluctance machines) for over 70 years (as described below), no one has made the combination. If the combination is obvious, then why has it not been done?

For over 160 years, machine designers have employed a non-segmented stator in switched reluctance machines. One of the earliest recorded switched reluctance motors was built by Davidson in Scotland in 1838. "Switched Reluctance Motors and their Control", T. J. E. Miller (Magna Physics Publishing 1993), p. 5 (attached hereto).

Non-segmented stators in switched reluctance machines continued to be used for over 70 years after the use of segmented stators in other types of electric

machines. Barr, which issued in 1930, teaches a segmented stator for an electric machine, but does not disclose the use of the segmented stator in a switched reluctance electric machine. Trago et al. shows a switched reluctance machine that is not segmented.

Neither the Examiner nor Applicants are able to identify any examples of switched reluctance electric machines with a segmented stator. This may be due to one of the key advantages of switched reluctance motors ~ simple construction. In the Introduction of "Switched Reluctance Motors and their Control", Miller states:

The geometry [of the switched reluctance motor] is beguilingly simple, and everything about the motor and its control seems at first sight to be a gift to the production engineer. Yet the attainment of good designs and satisfactory performance is practically impossible by traditional design methods.

See Introduction attached hereto. Segmenting the stator clearly increases the complexity of the design, which is counter to one of the primary reasons for using switched reluctance machines in the first place.

Based on the foregoing, it is clear that the conventional wisdom is to use non-segmented stators when designing switched reluctance machines. Proceeding against the conventional wisdom is evidence of nonobviousness. Arkie Lures Inc. v. Gene Larew Tackle, Inc., 43 USPQ2d 1294, 1297 (Fed.Cir. 1997); In re Hedges, 783 F.2d 1038, 1041, 228 USPQ 685, 687 (Fed. Cir. 1986). Here, Applicants have made the construction of the switched reluctance motor more complex by segmenting the stator. The geometry is no longer "beguilingly simple".

None of the references show, teach or suggest first and second end caps including a first inner winding retainer section that extends axially to connect an inner

end of the first end cap to an inner end of the second end cap.

McCoy shows a sleeve 30 that connects a lower middle portion of one end cap 50 to a lower middle portion of another end cap 40 as can be seen in FIGs. 1 and 2. The connection to the end cap 40 is spaced from the inner end. The sleeve 32 is not connected at the inner end of the end caps 40. Rather, the flanges 52 are connected to the inner ends of the end caps 40. The flanges 52 extend axially from the inner ends of the end caps 40 but do not connect the inner end of one end cap 40 with an inner end of the other end cap 40 as set forth in Claim 15.

The Examiner admits that Barr and Trago et al. also do not show, teach or suggest first and second end caps including a first inner winding retainer section that extends axially to connect an inner end of the first end cap to an inner end of the second end cap.

For the foregoing reasons, Applicants believe that Claim 15 is allowable. Claims 16-19 are directly or indirectly dependent upon Claim 15 and are allowable for the same reasons.

REJECTION OF CLAIMS 20-24 UNDER 35 U.S.C. § 103

Applicants traverse the rejection of Claims 20-24 under 35 U.S.C. § 103(a) as being unpatentable over McCoy (U.S. Pat. No. 4,340,829) in view of Trago et al. (U.S. Pat. No. 5,806,169).

Regarding Claim 20, none of the references alone or in combination show, teach or suggest a switched reluctance electric machine including a plurality of stator segment assemblies each with a stator segment core. As was discussed in detail

above, the separate teachings have coexisted in the machine art for over 70 years, and yet the Examiner is unable to find any reference that shows a segmented switched reluctance machine. In light of the arguments set forth above, the combination proposed by the Examiner cannot stand.

Regarding Claim 20, none of the references show, teach or suggest first and second end caps including a first inner winding retainer section that extends axially to connect an inner end of the first end cap to an inner end of the second end cap.

As set forth above, McCoy shows a sleeve 30 that connects an inner middle portion of one end cap 40 to an inner middle portion of another end cap 40 as can be seen in FIGs. 1 and 2. The flanges 52, which extend axially from the inner ends of the end caps 40, do not connect the inner end of one end cap 40 with an inner end of the other end cap 40 as set forth in Claim 20.

The Examiner admits that Trago et al. also does not show, teach or suggest first and second end caps including a first inner winding retainer section that extends axially to connect an inner end of the first end cap to an inner end of the second end cap.

For the foregoing reasons, Applicants believe that Claim 20 is allowable. Claims 21-24 are directly or indirectly dependent upon Claim 20 and are allowable for the same reasons.

REJECTION OF CLAIMS 25-28 UNDER 35 U.S.C. § 103

Applicants traverse the rejection of Claims 25-28 under 35 U.S.C. § 103(a) as being unpatentable over McCoy (U.S. Pat. No. 4,340,829) in view of Trago et al.

(U.S. Pat. No. 5,806,169) and Barr (U.S. Pat. No. 1,756,672).

As set forth in detail above, none of the references, alone or in combination, show, teach or suggest a switched reluctance motor including a stator that is segmented as set forth in Claim 25.

As discussed above, the separate teachings have coexisted in the machine art for over 70 years without any express teaching or suggestion to make the combination. Based on this fact and others set forth above, Applicants respectfully assert that the Examiner's current rejection of Claim 25 cannot stand.

For the foregoing reasons, Applicants believe that Claim 25 is allowable. Claims 26-28 are directly or indirectly dependent upon Claim 25 and are allowable for the same reasons.

CONCLUSION

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1211.

Respectfully submitted,

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By: Michael D. Wiggins
Michael D. Wiggins
Reg. No. 34,754

HARNESS, DICKEY & PIERCE, P.L.C.
P.O. Box 828
Bloomfield Hills, Michigan 48303
(248) 641-1600

ATTACHMENT FOR CLAIM AMENDMENTS

The following is a marked up version of each amended claim in which underlines indicates insertions and brackets indicate deletions.

1. (Amended) In an electric machine with a circumferentially segmented stator, a [A] winding end cap assembly [for an electric machine that includes] for a stator segment assembly including a stator core defining a [with] stator [poles] pole, comprising:

first and second end caps that are connected to opposite axial end surfaces of [one of] said stator [poles] core; and

a first inner winding retainer section that extends axially to connect an inner end of said first end cap to an inner end of said second end cap.

29. (Amended) A stator segment assembly for a circumferentially segmented stator of an electric machine, comprising:

a stator segment core for a stator pole of said stator segment assembly that includes first and second [axial] side surfaces that extend axially;

a first winding retainer section that [is positioned] extends continuously along said first axial side surface; and

winding wire that is wound around said stator segment core and that is retained by said first winding retainer section.

30. (Amended) The stator segment assembly of claim 29 further comprising:

a second winding retainer section that [is connected] extends continuously along said second axial side surface.

31. (Amended) The stator segment assembly of claim 29 further comprising:

a third winding retainer section that [is connected] extends continuously along said first axial side surface in a position that is radially outside of said first winding retainer section.

32. (Amended) The stator segment assembly of claim 30 further comprising:

a fourth winding retainer section that [is connected] extends continuously along said second axial side surface in a position that is radially outside of said second winding retainer section.

34. (Amended) A stator segment assembly for [an] a circumferentially segmented stator of an electric machine, comprising:

a stator segment core defining a stator pole;

a winding retainer attached to said stator segment core, wherein said winding retainer defines a substantially continuous annular channel around said stator segment core; and

winding wire that is wound in said continuous annular channel.